diagram represent inches.) The undulations generally vary from three to four inches at intervals of from fourteen to eighteen minutes. The centre of the storm which caused these oscillations was over the State of Florida, 1300 miles distant. This storm centre travelled slowly but directly to the lake region, where it caused a severe gale. These lake undulations are found to be of a more sensitive character than the indications of approaching storms given by the barometer. Mr. Denison is of opinion that these oscillations are due to the action of atmospheric waves or billows in passing over the surface of the lakes, which tend to form minute undulations upon the surface corresponding in length to these billows, and becoming magnified when they reach narrower and shallower portions, until finally they assume the proportions recorded upon the instrument.

Attention has also recently been directed to the minor undulations which occur in tidal waters by Mr. W. Bell Dawson, the Government surveyor engaged in the tidal survey of the Gulf of St. Lawrence, in a paper presented to the Royal Society of Canada in May 1895, entitled "Notes on secondary undulations." These undulatory disturbances in the regular rise and fall of the tides in the Gulf of St. Lawrence are plainly marked on the records of the self-registering tide gauges, their magnitude being in proportion to the amplitude of the tides. Similar undulations have also been observed in the Mediterranean at Malta. The illustration (Fig. 2, taken from Mr. Dawson's paper) shows the character of these undulations at high and low water in part of the Bay of Fundy, on tides having an amplitude of from 17 to 19 feet.

W. H. WHEELER.

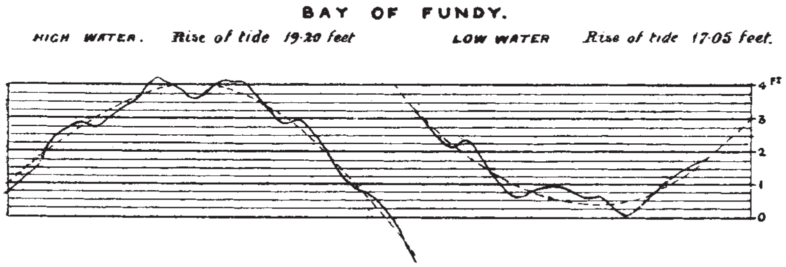

FIG. 2.

NOTES.

THE meeting of the Royal Society on Thursday, February 24, will be devoted to a discussion of the "scientific advantages of an Antarctic Expedition." The debate will be opened by Dr. John Murray, F.R.S., of the *Challenger*.

PROF. L. CREMONA, professor of higher mathematics in the University of Rome, has been elected a Correspondant of the Paris Academy of Sciences, in succession to the late Prof. Sylvester.

H.R.H. THE PRINCE OF WALES has been graciously pleased to accept the post of Patron of the fourth International Congress of Zoology, to be held at Cambridge next August.

A MEETING will be held in Manchester on February 16 to take into consideration such steps as may seem desirable to assist the Executive Committee in making the Zoological Congress this year thoroughly successful. The Literary and Philosophical Society have put their rooms at the disposal of the meeting, and Mr. J. Cosmo Melvill will take the chair at 5 o'clock on that day. This appears to us to be an excellent movement, and one worthy of imitation in other large centres. Zoologists who propose to be present should communicate with Prof. Hickson, F.R.S., at the Owens College, Manchester.

MR. THOMAS H. BLAKESLEY has resigned his seat at the Council Board of the Physical Society. He is, therefore, no longer hon. secretary of that Society.

IT has been decided to publish, under the auspices of the Physical Society and the Institution of Electrical Engineers, a series of abstracts of English, American, and foreign papers on physics and electrical engineering.

THE Harvard University, Cambridge, Mass., has invited Dr. Hans Reusch, Director of the Norwegian Geological Survey, to give two series of lectures—one on "Vulcanism," the other on "the Geology of Scandinavia." Dr. Reusch will return to Christiania in June.

AT the annual meeting of the Royal Microscopical Society on Wednesday, January 19, the President, after reviewing the progress in microscopical science during the past year, gave for his address an account of the manner in which achromatic doublets and triplets were practically calculated. The President explained by drawings on the blackboard the general scope of the paper, which, owing to its mathematical treatment, could not be read verbatim.

THE death is announced of Dr. Samuel Newth, author of "A First Book of Natural Philosophy," which has had a very large sale, and "The Elements of Mathematics, including Hydrostatics." In 1855 Dr. Newth became professor of mathematics and ecclesiastical history in the New College, St. John's Wood, and succeeded Dr. Halley as principal of the College in 1872, retiring from this post in 1889.

WE learn from *Science* that, at the meeting of the Corporation of Yale University on January 13, Prof. O. C. Marsh, professor of palæontology, formally presented to the University the valuable scientific collections belonging to him, now deposited in the Peabody Museum. These collections, six in number, are in many respects the most extensive and valuable of any in America, and have been brought together by Prof. Marsh, at great labour and expense, during the last thirty years. They include collections of vertebrate fossils, fossil footprints, invertebrate fossils, recent osteology, American archæology and ethnology, and minerals. The palæontological collections are well known, and were mainly secured by Prof. Marsh during his explorations in the Rocky Mountains. They include most of the type specimens he has described in his various publications. The collection of osteology and that of American archæology are also extensive and of great interest. The present value of all these collections makes this the most important gift to natural science that Yale has yet received. The President and Fellows of Yale accepted Prof. Marsh's gift by a unanimous vote, and expressed their high appreciation of his generosity to the University.

AMONG the papers to be read at forthcoming meetings of the Society of Arts are the following:—Ordinary meetings (Wednesday evenings, at eight o'clock): February 23, children's sight, by Mr. R. Brudenell Carter; March 2, kites, their theory and practice, by Captain B. F. S. Baden-Powell; March 9, Linde's method of producing extreme cold and liquefying air, by Prof. J. A. Ewing, F.R.S.; March 16, the recent history of paper-making, by Mr. Clayton Beadle; March 23, the preparation of meat extracts, by Mr. C. R. Valentine; March 30, telegraphy across space, by Prof. Silvanus P. Thompson, F.R.S. Indian Section (Thursday afternoons, at 4.30 o'clock): February 17, the plague in Bombay, by Dr. Herbert Mills Birdwood; March 31, the earthquake in Assam, by Mr. Henry Luttman-Johnson. Foreign and Colonial Section (Tuesday afternoons at 4.30 o'clock): February 15, the goldfields of Klondike and British Columbia, by Mr. W. Hamilton Merritt. April 5, the sugar industry in the West Indies, by Mr. T. R. Tufnell. Cantor Lectures (Monday evenings, at eight o'clock): Prof. W. Noel Hartley, F.R.S., the thermo-chemistry of the Bessemer process (three lectures); Dr. D. Morris, C.M.G., india-rubber (two lectures); Prof. Carus Wilson, electric traction (four lectures).

A few particulars with reference to the late Dr. George Henry Horn, President of the American Entomological Society, are given in the *Entomologist's Monthly Magazine.* Dr. Horn was born April 7, 1840, in Philadelphia, and died November 24, 1897. He graduated in medicine in 1861, and from 1862 to 1866 was surgeon in the U.S. army. Subsequently he established himself as a physician in Philadelphia, and had an extensive practice. Before he graduated he published papers on recent and fossil corals, but eventually turned his attention entirely to North American *Coleoptera*, as a pupil of, and fellow-worker with, Leconte, until the death of the latter in 1883, and afterwards on his own account. It has been said that if the death of Leconte was a severe blow to North American coleopterology, that of Horn is probably greater. His first entomological paper was published in 1860, and was followed by others (jointly or separately) to the number of about 150, appearing almost entirely in America, but he worked out the *Eucnemidæ* for the "Biologia Centrali-Americana." As already announced, his collections, and a sum of money, have been left to the American Entomological Society, of which he had been long President.

Prof. David P. Todd, Director of Amherst College Observatory, Amherst, Massachusetts, U.S.A., has nearly completed a bibliography of eclipse research to join on with Ranyard's classic work published many years ago in the *Memoirs* of the Royal Astronomical Society. He would be glad to receive copies of papers and titles of works and articles published since 1875.

The Lincolnshire Science Society, the establishment of which was referred to in Nature of December 30, 1897, should apparently have been christened the Lincoln Science Society; for a prospectus just received shows that a Lincolnshire Naturalists' Union has been in existence several years. There is hardly room for two county Societies having the same aims and objects, and the establishment of the new Society cannot but have a prejudicial effect upon the older Union, which ought to represent the combined forces of the different local societies in Lincolnshire. For the spirit of competition to enter into the matter at all is a mistake, and if the two organisations do not arrive at a concordat, the work of one will prejudice rather than assist the work of the other. It appears that the Lincolnshire Naturalists' Union initiated a scheme for the formation of a County Museum before the new Society took up the matter.

In the last number of the U.S. *Monthly Weather Review* (October 1897), the editor draws attention to a proposal for establishing a meteorological station on Satulah Mountain, North Carolina, at an altitude of about 5000 feet. The summit of the peak is fairly level, and, with the exception of about a quarter of a mile, is accessible by vehicles. Prof. Abbe points out that a continuous record at the summit would undoubtedly contribute to the elucidation of some interesting meteorological problems, but that in view of the many unsuccessful attempts to maintain self-recording instruments in isolated places, watchful observers would be necessary. Systematic observations are being made at great elevations by means of balloons and kites, and these efforts may be usefully supplemented by renewed attention to the establishment of mountain stations.

At the meeting of the French Meteorological Society on January 4, M. Moureaux made an important communication on the results of a mission entrusted to him by the Imperial Geographical Society of St. Petersburg with reference to the magnetic exploration of the Government of Koursk. The whole area of this province is intensely disturbed, and the differences between theory and observation are so great that it is not possible to draw isomagnetic lines. At two points situated about 450 yards apart the declinations are − 11° and + 45°. In one district the declination at two stations about a mile and a quarter apart varied from − 34° to + 96°. The dip ranged from 48° to 79°, and the horizontal component reached 0·59, whereas the maximum normal value of this element in the equatorial regions is below 0·40. From these observations it results that the magnetic force in that locality is as great as it would be in the immediate vicinity of the magnetic poles. So far as is known at present, there is nothing near the surface of the ground to cause these anomalies.

The tracing of the pretty curves formed by compounding pendulum vibrations of different periods is a fascinating pastime of which we were beginning to believe the resources were pretty well exhausted. Prof. Charles Schlichter, of Winconsin, has, however, discovered "fresh woods and pastures new" by extending the method to space of three dimensions, and representing, by the aid of the stereoscope, the resultant of harmonic motions of three frequencies in three different directions mutually at right angles. To do this, Prof. Schlichter attaches a miniature electric lamp to the bob of a Blackburn pendulum vibrating in a horizontal plane, and photographs the tiny speck of light by means of a stereoscopic camera attached to a pendulum which swings in a vertical plane about a horizontal axis through the optical centres of the lenses. This last pendulum gives the third vibration-component. When the diagrams are viewed through the stereoscope, the curves spring out into relief like bent wires; their forms for many of the higher ratios, such as 5 : 6 : 9 or 5 : 8 : 9 being very striking.

Experiments on the action of Röntgen rays on vegetable life have hitherto mostly led to negative results; but Signor G. Tolomei, writing in the *Atti dei Lincei*, is led to the conclusion that their action is identical with that of light. On exposing to the action of Röntgen rays branches of *Elodea canadensis* immersed in water charged with carbonic anhydride, evolution of bubbles took place as in the presence of sunshine or electric or magnesium light. The same similarity was observed in the effects on the lower vegetable forms, both Röntgen rays and light causing retardation in the absorption of oxygen by *Mycoderma aceti*, and in the evolution of carbonic anhydride by Saccharomyces. Again, in their action on *Bacillus anthracis* the Röntgen rays behave in the same way as sunshine, but in a minor degree; when a gelatine film was exposed for twenty-four hours to the radiations from a Crookes' tube, with the interposition of a zinc screen having an X-shaped aperture, the letter appeared transparent on an opaque background. That the action was due to destruction of the germs, and not to the generation of any toxic quality in the agar, was proved thus: when a sterilised film was partially exposed to the rays, and subsequently brought into contact with a stratum of dried spores, the spores began to germinate all over the film; but when the stratum of spores was exposed to the rays, the screen with the letter X being interposed, and the film subsequently brought into contact with them, only those spores which had been protected from the Röntgen rays developed, and the letter X was distinctly seen. Signor Tolomei attributes the previous failure to obtain such effects to the short duration of the exposures.

A LENGTHY report of the Committee, appointed by the Academy of Science and Literature at Montpellier, to inquire into the alleged vision through opaque objects, appears in *La Semaine Médicale* (January 19). The Committee prepared three letters, the contents of which could not be known to them, by writing words and numbers on sixty-four cards, placing them two and two into envelopes, and selecting three of the thirty-two envelopes haphazard; these three were carefully sealed. One envelope was sewn into the coat, another placed in the pocket of a member; the third, along with half an exposed photographic plate, was wrapped in many thicknesses of paper and placed in a box, which was also sealed. At Narbonne the box containing the envelope and plate was placed on Dr. Ferroul's table, since that was the usual position of the documents which had already been read by Mlle. X. The Committee then walked to Mlle. X.'s abode, about 300 metres from Dr. Ferroul's house. Mlle. X. did not succeed in reading the contents of the envelopes carried by the members of the Committee, and at first no success attended attempts to describe the contents of the sealed box. About an hour and a half after the commencement of the séance, during which time Mlle. X.'s sister passed to and fro, and Mlle. X. herself left the room on more than one occasion, the contents of the box were more or less correctly described. On re-examining the box the Committee came to the conclusion that it had been opened, and on developing the contained piece of photographic plate along with the other part, the former piece was fogged, although the latter developed perfectly.

The British Medical Journal of January 22 contains a reprint of the special inquiry on the relative efficiency of certain kinds of water filters which has been carried out for the *Journal*. Many of the conclusions arrived at are by no means encouraging; for example, an examination of the portable filters supplied for Army Field Service revealed the fact that not one of these afforded any protection against water-borne disease; that, on the contrary, "they would tend to increase rather than diminish the risk incurred by those making use of them, since when such filters had once been charged with contaminated water they would continue for some time afterwards to discharge the disease germs into the 'filtered' water." This is a very serious matter, and which, considering the numbers of cases of dysentery which have already occurred in the present Indian frontier war, might well demand the immediate attention of the Army Medical Department. The filter of the future remains as yet, it would seem, "a castle in the air"; where efficiency is procured, the rate of filtration is often such as to preclude it from practical use. It appears, however, likely that diatomaceous earths or natural stone will be generally preferred to denser media such as porcelain, these three being, amongst the materials at present in use for filters, the only ones which apparently supply an efficient filtering medium. The same number of the *Journal* contains a communication by E. H. Hankin on "a simple method of checking cholera in Indian villages," which consists in treating the wells in an infected district with potassium permanganate, a sufficient quantity being added in each case to give a pink colour lasting for several hours to the water. This plan appears to have produced favourable results in combating cholera outbreaks, and in some places even the natives have been induced to disinfect their wells by its means.

THE immense lava-sheets that cover an area of some two hundred thousand square miles in the Deccan of India have been looked upon as the grandest example of vulcanism in the world; but an even more extensive outpouring of similar material must formerly have been evident in the northern hemisphere, if we accept the conclusions reached by Messrs. Newton and Teall from a study of the geological collections made in Franz Josef Land by the Jackson-Harmsworth Expedition (*Quart. Journ. Geol. Soc.*, December 1897). That archipelago is formed of the fragments of an ancient basalt-plateau which must have stretched far beyond its present limits. Similar igneous rocks are found in Spitsbergen, Jan Mayen, Iceland, Greenland, the Faeroës, the Hebrides and North Ireland; and the authors are inclined to regard all these areas as the isolated fragments of a formerly continuous land-area, the greater part of which has sunk to form the northern portion of the North Atlantic Ocean. The period of this outpouring of lava was probably the end of Cretaceous and beginning of Tertiary times. This period seems to have been distinguished by similar occurrences in other parts of the world, for the great lava-flows of the Deccan and of Abyssinia are of the same age.

PROF. A. RICCÒ contributes to the latest *Bollettino* of the Italian Seismological Society an account of the Geodynamic Observatory of Catania, founded in 1891, and now one of the best equipped in Italy. It is situated beneath the astrophysical observatory, in the cellar of the former Benedictine convent. The principal instrument is one of Cancani's great seismometrographs, consisting of a pendulum 25·3 metres long and a mass of 300 kg., whose movements are magnified twelve and a half times, and recorded by two pens on a strip of paper moving at the rate of 60 cm. an hour. In addition to this valuable apparatus are two other seismometrographs (Brassart's and Cecchi's), a Guzzanti microseismoscope, one of Agamennone's photographically recording tromometers, a Cancani photochronograph, which, at the moment of a shock, photographs the face of a clock, four seismographic pendulums of different lengths and masses, ten seismoscopes of various patterns for calling attention to the occurrence of a shock, and a puteometer which records the movements of the water-surface in a well 32½ metres deep.

WE have received from the Meteorological Reporter for Western India a copy of his "Brief Sketch of the Meteorology of the Bombay Presidency for the Year 1896-97." The weather during the year presented several features of unusual character; for instance, unseasonable distribution of rainfall, for, although the annual amount was above the average in most districts, the deficiency was very great in September and October, and it was owing to this that the crops withered and caused widespread famine. Another feature was the prevalence of abnormally high temperatures; in April and October the means were respectively 6° and 7° above the average. These conditions appeared to have considerable effect upon the plague; from August to November the mortality increased with an abnormal rise of temperature, and *vice versâ*, whereas the high temperature of April appears to have had the effect of decreasing the mortality in that month. This report contains some interesting details of floods in the river Tápti since 1727; the highest flood on record—viz. 100¼ feet—occurred in July 1883, while that of July 1896—viz. 98 feet—occupies the third place on record.

THE part for January 1898 of "The Garden," edited by Mr. W. Robinson, presents a very attractive contents to the gardener and horticulturist. There are longer or shorter notes on almost every department of gardening; and no less than four coloured plates, besides numerous woodcuts, are included in the price of one shilling.

In the *Journal* of the Royal Society of Bengal for 1897 (part ii. No. 2) is a brief article by Mr. F. Finn, of the Indian Museum, on the Theory of Warning Colours and of Mimicry. It records a series of experiments on a tree-shrew, *Tupaia ferruginea*, and on a bull-frog, *Rana tigrina*, but the results do not appear to be very conclusive.

Dr. L. Meshcinelli, of Vicenza, has issued a prospectus of a proposed Iconograph of all Fossil Fungi at present known. It will be published, probably in the earlier half of the present year, in the form of a quarto volume, with an atlas of more than thirty plates. The price to subscribers will be 30 francs, delivered free.

In a paper in *Natural Science* for August 1897, Mr. G. W. Bulman adopts very much the view of Prof. Plateau, that bees are not primarily attracted to flowers by their conspicuous colour, especially that they have no special partiality for blue. He also contests the statement that either honey-bees or wild bees are constant in their visits to the same species. Somewhat similar results appear to have been arrived at by Mr. Albert Gale from observations in Australia, of the record of which we find a commencement in the *Agricultural Gazette of New South Wales* for November 1897.

In our recent review of the "Vita Medica" of the late Sir B. W. Richardson, the author's part in emphasising the distinction between "enteric and typhoid (*sic*) fevers" was alluded to (p. 265). Our readers perceived at once, no doubt, that the name "typhoid" had crept into the text in place of typhus.

Under the title of *The Home University*, the publication of a magazine and note-book for private students of various branches of knowledge has just been commenced. The idea of the editors of the new periodical is to give the home-student assistance on difficult points, and furnish him with aids to memory. "We shall assume," it is added, "that, in addition to a knowledge of their own language, our readers possess the rudiments of French, Latin, German, and Greek, and that respecting Geography, History, Poetry, and the Natural Sciences they have made some kind of a beginning." The editors purpose not so much to try to increase knowledge as to convey it, and we wish them success in their undertaking, notwithstanding the fact that science takes a minor place in the first number of their educational medium. The periodical is published by the Educational Museum, Haslemere, and by Messrs. West, Newman, and Co.

The additions to the Zoological Society's Gardens during the past week include a Red Fox (*Canis fulvus*) from North America, presented by Mr. F. C. Ingram; four Virginian Opossums (*Didelphys virginiana*) from North America, presented by Mr. J. D. Sprunt; two Secretary Vultures (*Serpentarius reptilivorus*) from South Africa, presented by Mr. J. E. Matcham; a Laughing Kingfisher (*Dacelo gigantea*), a Lace Monitor (*Varanus varius*), a Blue-tongued Lizard (*Tiliqua scincoides*), two Stump-tailed Lizards (*Trachydosurus rugosus*) from Australia, presented by Mr. J. D. Waley; a Leopard (*Felis pardus*) from Ceylon, a Derbian Wallaby (*Macropus derbianus*) from Australia, deposited; two Uvæan Parrakeets (*Nymphicus uvænsis*) from the island of Uvea, Loyalty Group; two Black-headed Caiques (*Caica melanocephala*) from Demerara, an Ashy-black Ape (*Macacus ocreatus*) from the East Indies, three Curlews (*Numenius arquata*), three Oyster-catchers (*Hæmatopus ostralegus*) from Holland, purchased.

OUR ASTRONOMICAL COLUMN.

The Solar Eclipse.—Mr. F. W. Dyson, the Chief Assistant at the Greenwich Observatory, has sent the following letter to the press:—"Prof. Turner telegraphs from Bombay that the observations of the solar eclipse were very successful. The photographs taken by the Astronomer Royal, Prof. Turner, Captain Hills, Mr. Newall, and Dr. Copeland, have all been developed, and the results are excellent. Captain Hills has succeeded in photographing the spectrum of the reversing layer, and Prof. Turner has obtained marked results as to the amount of polarisation of the corona."

Large and Small Proper Motions.—In the *Astronomische Nachrichten* (No. 3466) Prof. Kapteyn announces the discovery of a star with an exceedingly large proper motion; this is the star in the Cordoba Zone Catalogue 5·243h., of about the 8th magnitude, but probably slightly variable, and having an orange-yellow colour. Its position from the "Cape" observations of 1897·8 for epoch 1875 is α = 5h. 6m. 56·0s., and $\delta = -44° 60'{\cdot}530$, which position is in the constellation of Pictor. The result of the investigations of Mr. Innes, of the Cape Observatory, and Prof. Kapteyn, gives the proper motion in a great circle as $8''{\cdot}7$, or in R.A., + 0·621s., and Decl. $-5''{\cdot}70$, which will be seen is even greater than that of the "runaway" star 1830 Groombridge, the proper motion of which, it will be remembered, is $7''{\cdot}05$ in a great circle, or in R.A. + 0·346s., and Decl. $-5''{\cdot}78$. We shall await with interest the determination of the parallax of this remarkable star, in order to discriminate whether its large proper motion is real or chiefly due to its close proximity to our system.

In contrast with the above, Mr. J. G. Porter has re-computed the proper motion of the star Bradley $2444^a = 3250$, availing himself of a much longer series of observations than those from which Dr. Auwers deduced the values +0·0040s. and $+0''{\cdot}128$; and while Mr. Porter's result of + 0·0024s. and $-0''{\cdot}030$ (as given in the *Astronomical Journal*, No. 422) confirms the small motion in right ascension, it negatives entirely the motion in declination; he therefore suggests that Dr. Auwers' result seems to have been due to a wrong reduction of the declinations of D'Agelet and Lalande.

The Comet of 1892 II.—It is not often that an opportunity occurs of basing the determination of a comet orbit on observations extending over so long a period as that available in the present instance. The series commenced in 1892, March 19, and ended 1893, January 12, during which period the comet passed over about 107° of true anomaly. The definitive orbit in this case proves to be hyperbolic, and the final result is entitled to considerable weight. The only unsatisfactory feature about it is the amount of the residuals in some of the normal places. Dr. L. Steiner, of O'Gyalla, who has made the calculations, bases them on Dr. Schorr's elements, from which he derives by comparison with his computed ephemeris, twelve normal places, necessarily varying considerably in point of accuracy. The solution of the equations of condition founded on these normal places gives for the excentricity the value 1·004404. The residuals to which we have referred as not being quite satisfactory do not occur at the end of the series, when the comet would necessarily be faintest and the observations scarcest, but in the middle of the series, practically from June to October. This is to some extent perhaps to be explained by the fact, that the comet was about that time very faint in telescopes of moderate size, and these observations, made with difficulty, may have had an injurious effect on those derived from the use of larger instruments. This explanation is not entirely satisfactory, for in one instance the normal place rests entirely on the measures made at one Observatory, that of Bordeaux. Dr. Steiner tries by alterations of the assigned "weights" to reduce these residuals, but the result is not quite satisfactory. Under the best circumstances, and when the excentricity is brought down to 1·000345, the sum of the squares of the residuals in the hyperbola is $103''{\cdot}2$, while on the assumption of parabolic motion the same sum is $279''{\cdot}5$. The orbit is almost perpendicular to the plane of the ecliptic.

Winnecke's Comet = *a* 1898.—From further observations made by Prof. Perrine at the Lick Observatory a new ephemeris of this comet has been determined; this, together with the elements, are given in the *Astronomical Journal* (No. 424) as follows:—

Elements.

$$T = 1898 \text{ March } 20{\cdot}392 \text{ G.M.T.}$$

$$\left.\begin{array}{rl} \omega = & 173^{\circ}\ 21'\ 10''{\cdot}0 \\ \Omega = & 100\ \ 51\ \ 45{\cdot}5 \\ i = & 16\ \ 59\ \ 34{\cdot}0 \end{array}\right\} 1898{\cdot}0$$

$$\log e = 9{\cdot}854161$$
$$\log a = 0{\cdot}510521$$